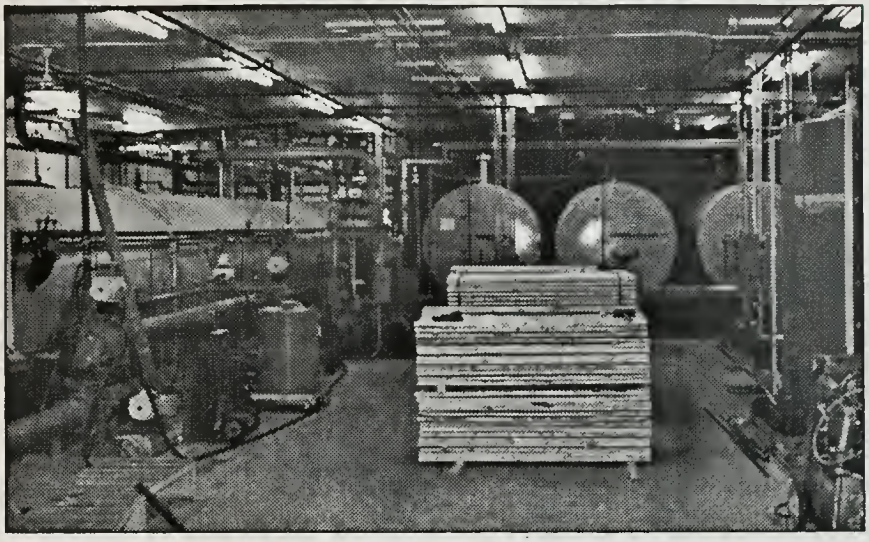
Ontario

Heat Pump Fixation and Drying System

"Guelph Utility Pole Company Ltd. is committed to producing wood products treated with chromated copper arsenate which are environmentally friendly. To achieve our goal, we designed a totally enclosed, ventless chamber to fixate and dry our treated wood products. The assistance of the Ministry of Environment and Energy made it possible for us to build a fixation chamber in which over 99.5% of the preservative is bound to the wood fibre."

Howard Frohlich
President
Guelph Utility Pole Company Ltd.
Guelph, Ontario



CCA plant – working solutions within enclosed containment facility.

THE COMPANY

Guelph Utility Pole Company Ltd. is a Canadian-owned company in the wood-treatment industry. Over the last few years the company has undertaken many expensive renovation projects to improve the efficiency and reduce the environmental impact of its wood treatment process.

THE CHALLENGE

Fixation of lumber and utility poles is necessary to form a permanent bond between the wood cells and the treatment chemicals. If complete fixation is not achieved, the chemicals will migrate out of the lumber and pollute the surrounding soil and water. The lifetime of the treated lumber also is reduced, since it becomes more susceptible to weather attack.

Fixation is best achieved by exposing the lumber to elevated humidity and temperature after pressure treatment. Traditionally, this was accomplished by heating the fixation (or drying) kiln with steam and then venting the hot and moist air to the outside when treatment was finished.

This meant high energy use and the release of large amounts of waste heat and chemical vapors into the atmosphere.

THE SOLUTION

Guelph Utility Pole has developed a different method and is now treating some 30,000 utility poles a year in a closed-loop process that recovers heat, water and treatment chemicals. Use of a heat pump to control the humidity and temperature has eliminated the need to vent heat, water and chemicals to the atmosphere.

THE TECHNOLOGY

Basically, the operation of the system is as follows:

* chromated copper arsenate (CCA) solution is forced into the wood under pressure in a treatment chamber in one building
* the wet wood is moved along a specially designed transfer system into another building which houses a huge, steel-lined kiln
* the air in the kiln is preheated by steam coils and direct steam injection to the proper temperature and humidity level
* the hot air is then blown over the treated wood, where it picks up moisture released by the wood
* the moist air is drawn into an exchange cabinet containing the heat pump evaporator where moisture is condensed as the refrigerant picks up the heat from the air;
* dry air passes across the condenser of the heat pump, is reheated and blown back into the kiln to pick up more moisture from the wood. At this point the air starts its cycle again.

Each kiln can remove approximately 600 pounds (about 270 kg) of water per hour. All of the condensate goes through a heat recovery and filter system. Pressure-treating chemicals and water are recovered and reused.

As more heat is recovered from the air in the evaporator than is necessary to reheat the dried air in the condenser, excess heat is used to heat process fluids and an adjacent 12,000-square-foot (1,115-square-metre) transfer area.

BENEFITS

The heat pump system with its accompanying heat recovery system

and controls provides the following benefits:

* improved fixation due to easier control of kiln conditions;
* no emissions to the atmosphere;
* lower energy consumption since the heat pump produces 3.5 - 4 times more energy than it uses for operation, and oil consumption has been reduced by 50 per cent;
* recovery of pressure-treating chemicals.

Butt treatment plants.

RESULTS

Initially, drying expectations were not met because the wood would not give up the moisture at the rate expected. When two more kilns were added, with an exchange cabinet with a powerful heat pump connected to each of the three kilns, the performance of the system was optimized.

The heat recovery system also was expanded to supply low-temperature heat to a 12,000-square-foot (1,115-square-metre) transfer area and a specially designed transfer system was incorporated for moving the wood into and out of the treatment chamber.

Guelph Utility Pole can now fixate and dry wood products quickly and efficiently. The result is a line of wood products treated with chromated copper arsenate which are environmentally safe, highly leach-resistant, and safe for storage, shipping and handling. Currently, the possibility of using a new high-temperature CFC-free refrigerant to increase drying temperatures is being researched. This will reduce drying time as well as provide the environmental benefits of using a CFC-free refrigerant.

The company is also looking at using reject heat from one chamber to preheat another and cascading the heat pumps for optimum efficiency.

FINANCIAL

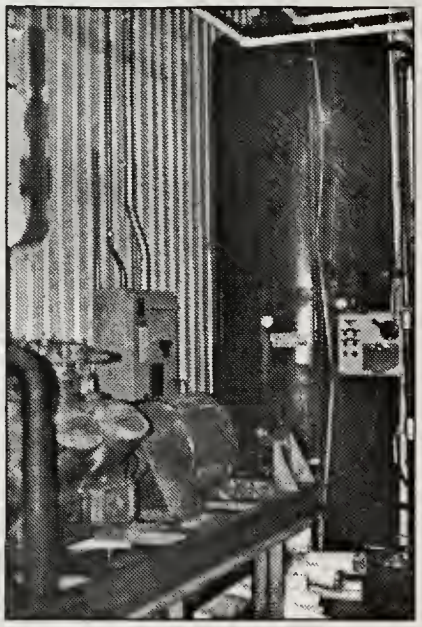
The net cost of the system was $458,000. The annual savings are estimated at $70,000, which means that the simple payback will be 6.5 years.

PARTNERSHIP IN POLLUTION PREVENTION AND RESOURCE CONSERVATION

Industrial companies located in Ontario may seek ministry/industry services that will help them to:

* use energy and water more efficiently;
* reduce, reuse and recycle solid waste;
* reduce or eliminate liquid effluent and gaseous emissions.

Equipment and services supply companies can benefit from the information provided on technologies identified for business development.



Energy efficient heat pump.

FOR FURTHER INFORMATION, PLEASE CONTACT:

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MINISTRY OF ENVIRONMENT AND ENERGY SERVICES

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Printed on recycled paper

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